PATENT ABSTRACTS OF JAPAN

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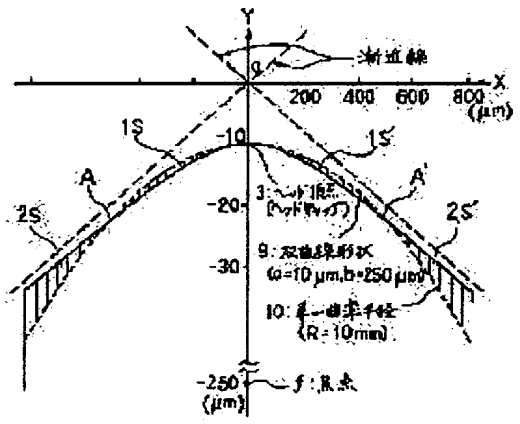
(54) MAGNETIC HEAD

(57)Abstract:
PURPOSE: TO obtain good recording and reproducing characteristics in a short time and to prolong the life of a magnetic head by forming the front end of the magnetic tape-sliding surface of the magnetic head to an approximately hyperbolic shape.
CONSTITUTION: The shape of the front end of the magnetic head in the head scanning direction of the magnetic tape-sliding surface of the magnetic head is formed to the hyperbolic shape having a radius R of curvature decreasing near a head gap and increasing the further from the head gap. A solid line 9 in Fig. shows the shape of the sliding surface of the magnetic head and a broken line 10 shows the sliding surface shape of the conventional magnetic head expressed by the single radius of curvature. Both surfaces intersect with each other at points A, A'. Then, the conventional magnetic head of the broken line 10 is larger in the cross sectional area by 1s, 1s' than the solid line 9 in the initial period of traveling of the tape and, therefore, the wear rate is slower with the conventional head. The solid line 9 is larger in the cross sectional area by 2s, 2s' than the broken line 10 when the tape travels up to points A, A' and, therefore, the magnetic head having the hyperbolic shape is slower in the wear rate. As a result, the stable head tape contact state is obtd. by short time of running-in traveling and the longer life is obtd.



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CLAIMS

[Claim(s)]
[Claim 1] The magnetic head which constitutes and changes so that it carries in a rotating cylinder, it is the magnetic head which slides with a magnetic tape with a predetermined relative velocity, and performs record reproduction of an information signal, and the radius of curvature R of the head scanning direction o a sliding surface with a magnetic tape is made into smallness near the head gap, and it may consider as size as it separates from a head gap.
[Claim 2] The magnetic head according to claim 1 which changes considering the nose-of-cam configuration of the magnetic head of the head scanning direction of a magnetic tape sliding surface as an abbreviation hyperbola configuration.
[Claim 3] Inclination of the asymptote of the hyperbola which shows a sliding-surface configuration with the magnetic tape of the magnetic head The claim 1 which makes a/b smallness by the close side which contacts a magnetic tape first, and changes as a size in the appearance side of the magnetic tape of an opposite side, or the magnetic head given in two.
[Claim 4] The magnetic head according to claim 1 which changes considering the nose-of-cam configuration of the magnetic head of the head scanning direction of a magnetic tape sliding surface as an abbreviation parabola configuration.
[Claim 5] The magnetic head according to claim 1 which changes considering the nose-of-cam configuration of the magnetic head of the head scanning direction of a magnetic tape sliding surface as an abbreviation elliptical.
[Claim 6] About the radius of curvature R1 of the head scanning direction of the magnetic tape sliding surface near the head gap, it is 3mm. <= R1 <= 10mm It accomplishes and is 10mm about the radius of curvature R2 near the magnetic-head edge of the head scanning direction of a magnetic tape sliding surface. <= R2 <= The claim 1 which changes as 20mm, or the magnetic head given [any 1] in five.
[Claim 7] It is 50 micrometers about the width of face W of the magnetic tape sliding surface of a head scanning direction. <= W <= The claim 1 which changes as 100 micrometers, or the magnetic head given [any 1] in six.
[Claim 8] Through nonmagnetic material, in the height, the metal magnetic film of the couple which has the reverse V character-like Yamagata salient configuration, and constitutes a magnetic circuit compares mutually, and changes. It is a right-angled flat surface. the cross-section portion of a reverse V character-like configuration -- a magnetic tape opposed face -- exposing -- the nose of cam of the height of the metal magnetic film of a couple -- mutual -- parallel -- and a head scanning direction -- abbreviation -- The plane width of face shown by the nodal line of this flat surface and a magnetic tape opposed face corresponds to the width of recording track. One [at least] metal magnetic film is the magnetic head the claim 1 which is formed on the magnetic substrate material which has the height of the configuration corresponding to [have a coil coil aperture and] the shape of reverse V character in a metal magnetic film and changes, or given [any 1] in seven.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] VTR with which this invention relates to the magnetic head used for a magnetic recorder and reproducing device, especially a high-speed head scan is demanded -- good -- it is related with the **** magnetic head
[0002]
[Description of the Prior Art] Generally, with VTR, in order to perform record reproduction of a wide band signal, relative velocity between the magnetic head carried in the rotating cylinder and a magnetic tape is made high-speed. Therefore, when it is required to make the magnetic head contact a magnetic tape good and a spacing (crevice between the magnetic head and a tape) etc. occurs, the record reproducing characteristics of the magnetic head will be spoiled. In order to stop such un-arranging and to obtain good record reproducing characteristics, the configuration (the sliding-surface configuration of the magnetic head is called hereafter) of the magnetic head which contacts a magnetic tape becomes important.
[0003] The sliding-surface configuration of the magnetic head from the former is explained using drawing 5 and drawing 6 . Drawing 5 is the outline plan showing the sliding-surface configuration of the conventional magnetic head, and drawing 6 is the front view of the sliding surface of the conventional magnetic head. In drawing 5 , the nonmagnetic membrane (not shown) was formed in the abutting surface of each core so tha predetermined magnetic-gap length might be obtained in the ferrite core base 5 of a couple, and 5', and the magnetic gap 3 is regulated.
[0004] Moreover, regulation of the width of recording track Tw perpendicular to the head scanning direction shown in drawing 6 was performed by cutting to the ferrite core base 5 and 5', and forming the chip section 2, and this end chip section 2 is filled up with the glass for joining a ferrite core. And in order to obtain good tape contact, configuration processing (R configuration processing is called hereafter) of R is given to the tape sliding surface 1 of the magnetic head for the radius of curvature of a head scanning direction. In addition, the tape contact angle of the head scanning direction at this time is set to theta.
[0005] Generally, this R configuration processing is performed using the grinding process machine or the polish tape. thus, the thing performed for R configuration processing to the head scanning direction of a head sliding surface -- deformation of the magnetic tape near the tape sliding surface -- a tape sliding-surface configuration and abbreviation -- it changes that it is the same Therefore, the good contact to a magnetic tape is obtained and the magnetic head the spacing loss excelled [magnetic head] in record reproducing characteristics small is obtained.
[0006] in addition -- as the thing about the good contact to such a magnetic tape -- for example, the collection of 1986 television society national conference drafts -- "application on 4 run head VTR of tape surfacing type-number value analysis" of a publication is mentioned [157th page - page / 158th]
[0007]
[Problem(s) to be Solved by the Invention] With the above sliding-surface configurations of the magnetic head, the contact to a magnetic tape becomes good. However, by the magnetic head from the former, it was not taken into consideration at all about the sliding-surface configuration about the wear life of the magnetic head only in the sliding-surface configuration about the contact to a magnetic tape. R configuration of this tape sliding surface became clear by examination which also affecting the wear life of the magnetic head shows below.
[0008] Generally, the wear life of the magnetic head is determined by the length Gd of the magnetic-gap

side shown in drawing 5 . Although what is necessary is just to set up Gd for a long time for lengthening a wear life, according to length, the magnetic reluctance of the gap section will become small, and a record magnetic field will decrease. Moreover, since the magnetic flux which passes along the gap section increases, a regeneration efficiency will also fall. Therefore, when long wear life-ization is attained only by the length of Gd, there is a problem that record reproducing characteristics are spoiled.
[0009] On the other hand, abrasion loss deltaGd of the radius of curvature R of a head scanning direction and the length Gd of a magnetic-gap side is expressed like following the (1) formula in approximation.
[0010]
[Equation 1]

$$\Delta Gd = \frac{V}{R \cdot Sin(\theta/2) \cdot W} \quad \cdots (1)$$

[0011] (V:wear volume, the tape contact angle (theta shown in drawing 5) of a theta:head scanning direction, sliding width of face of W:tape cross direction)
(1) What is necessary is just to enlarge the radius of curvature R of the tape run direction, for lengthening a wear life, when sliding width of face W is fixed so that clearly from a formula. However, when radius of curvature R is enlarged, there is a problem referred to as taking a long time to obtain good tape contact according to the factor shown below.
[0012] That is, in the early stages of a magnetic tape run, a difference arises according to the assembly error of the magnetic head, the processing error of a rotating drum, etc. in the tape sliding-surface configuration of the magnetic head, and the tape deformation near the magnetic gap. Therefore, a large nex door and good record reproducing characteristics are hard to obtain a spacing loss. then -- until this tape sliding-surface configuration gets used to tape deformation -- namely, a tape sliding-surface configuration and tape deformation -- abbreviation -- it is necessary to perform a training run of a magnetic tape until it becomes the same, and it is necessary to perform the grinding of a magnetic-head sliding surface However a long time is taken for ** and the tape sliding-surface configuration where a wear rate also becomes slow to get used to tape deformation, if radius of curvature R is enlarged. Therefore, if radius of curvature R is enlarged, a long time will be required by the time good tape contact is obtained.
[0013] What is necessary is just to make it easy to raise precision, such as a tape sliding-surface configuration of the magnetic head, assembly of the magnetic head, and processing of a rotating drum, or to make radius of curvature R small, and to wear the magnetic head out, in order to shorten the training transit time. However, in order for there to be a limitation in precision, such as a sliding-surface configuration and assembly processing, and to acquire precision, various fine tuning etc. takes time. Consequently, since efficiency becomes bad and the yield also falls, it is not suitable for mass production to raise precision. Moreover, when radius of curvature R is made small, there is a problem that a wear life becomes short.
[0014] Therefore, the purpose of this invention solves the trouble of the above-mentioned conventional technology, and is to obtain good record reproducing characteristics to a short-time training run, and offer the long lasting magnetic head.
[0015]
[Means for Solving the Problem] In order to solve the above-mentioned problem, this invention makes smallness the radius of curvature R of the head scanning direction of a sliding surface with the magnetic tape of the magnetic head near the head gap, and it constitutes it so that it may consider as size as it separates from a head gap.
[0016] For example, with the position from a head gap, in order to change the radius of curvature R of a sliding surface with the magnetic tape of the magnetic head, it constitutes so that the sliding-surface configuration of the magnetic head of the head scanning direction of a magnetic tape sliding surface may be made into an abbreviation hyperbola configuration.
[0017] At this time, the air film produced by high-speed rotation of a rotating cylinder is thick in the close side of the magnetic head which contacts a magnetic tape first, and becomes thin by the appearance side of the magnetic tape of an opposite side. That is, it is easier to wear rather than the close side of the magnetic head out an appearance side. Then, the inclination (a/b) of the asymptote of the hyperbola which shows a sliding-surface configuration with the magnetic tape of the magnetic head may be made into smallness, and it may consist of appearance sides of the magnetic tape of an opposite side at the close

side which contacts a magnetic tape first so that it may consider as size.
[0018] However, when smaller than the radius of curvature of R= 3mm, a wear life becomes remarkably short, and if desirable conditions are shown practical, in being conversely larger than R= 10mm, the grinding of a magnetic-head sliding surface will become difficult for a short time. Furthermore, when larger than R= 20mm, the spacing loss between the magnetic head and a magnetic tape increases, and good tape contact is not obtained. the reason of ** -- the radius of curvature R1 of the head scanning direction of the magnetic tape sliding surface near the head gap -- 3mm <= R1 <= the radius of curvature R2 near the magnetic-head edge of the head scanning direction of 10mm magnetic tape sliding surface (i.e., the sliding edge of the magnetic head and a tape) -- 10mm <= R2 <= 20mm ** -- carrying out is desirable At this time, the magnetic head does not limit especially constituting the main magnetic circuit from ferrite materia which has a metal magnetic film or high permeability etc.
[0019] Moreover, when smaller than W= 50 micrometers, the intensity of a sliding surface with the magnetic tape of the magnetic head will become weak, and breakage of a head will produce the width of face W of the sliding surface of the magnetic head and a magnetic tape under the influence of dust etc. during a tape run. On the contrary, about a wear life, in being larger than W= 100 micrometers, although it is advantageous, according to examination, there are problems -- good tape contact is not obtained by the rigid difference in a magnetic tape. By the reason of **, it is 50 micrometers preferably practical. <= W <= 100 micrometers It carries out.
[0020] Furthermore, near the head gap, the radius of curvature R of a head scanning direction may constitute the sliding-surface configuration of the magnetic head from smallness so that it may become a parabola configuration used as size, or elliptical as it separates from a head gap.
[0021]
[Function] An operation of the radius of curvature R in the magnetic head of this invention is explained using drawing 1 . This drawing is a cross-sectional view of the magnetic head showing typically comparison of a sliding-surface configuration with the tape of a head scanning direction of the case made into the hyperbola configuration, for example so that it may become size, and the case where radius of curvature R is set constant as radius of curvature R separates from a head gap by smallness near the head gap. However, in this drawing, a solid line 9 shows the sliding-surface configuration of this invention expressed with the hyperbola, and a dashed line 10 shows the conventional sliding-surface configuration expressed with single radius of curvature.
[0022] The hyperbola shown as a solid line 9 is expressed with following the (2) formula when the X-axis is set as a Y-axis and the tape sliding direction for the direction of a magnetic-gap side.
[0023]
[Equation 2]

$$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1 \qquad \cdots (2)$$

[0024] Here, a and b are constants which determine the configuration of a hyperbola, and are two asymptotes of a hyperbola. Y=** (a/b) and X The distance from the intersection (X, zero of a Y-axis) to the head peak 3 (head gap) is set to a. And it is 0<a<c when distance from the zero to the focus f of a hyperbola is set to c. It reaches. c2=a2+b2 It has a relation.
[0025] In drawing 1 , the sliding-surface configuration of a head crosses by Point A and A' conventionally which is expressed with the single radius of curvature indicated to be the sliding-surface configuration expressed with the hyperbola shown as a solid line 9 with a dashed line 10. therefore -- a hyperbola -- a configuration -- the magnetic head -- single -- radius of curvature -- a configuration -- the former -- the magnetic head -- receiving -- drawing 1 -- a slash -- the section -- one -- s -- two -- s -- one -- s -- -- two -- s -- ' -- being shown -- the cross section -- a configuration -- a difference -- obtaining .
[0026] About sliding width of face, abrasion loss deltaGd of the length Gd of a magnetic-gap side is proportional to the wear volume V so that clearly from the same, then (1) formula. That is, abrasion loss deltaGd is proportional to the cross section of the tape sliding section of the magnetic head shown in drawing 1 . Moreover, in early stages of a tape run, a tape contacts only near the head gap, and a tape comes to contact the whole sliding surface as it runs.
[0027] At this time, as shown in drawing 1 , since only 1s and 1s' have the large cross sectional area, in the head, in the early stages of a tape run, a wear rate becomes [the conventional magnetic head of a dashed

line 10] slow conventionally from a solid line 9. And contrary to the early stages of a tape run, if it is ground and wears out to Point A and A' as it runs, since only 2s and 2s' have the large cross sectional area in the magnetic head of the hyperbola configuration of this invention, a wear rate will become [the solid line 9] slow from a dashed line 10.

[0028] That is, a wear rate becomes slow as it runs by the wear rate of the magnetic head of this invention which made the sliding-surface configuration with a tape the hyperbola compared with the conventional single radius-of-curvature configuration head being quick in the early stages of a tape run. Since a stable head tape contact state is acquired to a short-time training run by this and a wear rate becomes slow according to a run, the long lasting magnetic head is obtained.

[0029] Therefore, the radius of curvature of the tape sliding surface of the magnetic head constitutes so that it may become large continuously as it is small and separates from a gap near the head gap like a hyperbola. Good record reproducing characteristics are obtained by this for a short time, and the reinforcement of the magnetic head also becomes realizable.

[0030] Moreover, the inclination (a/b) of the asymptote of the hyperbola which shows a sliding-surface configuration with the magnetic tape of the magnetic head is made into smallness, and it consists of appearance sides of the magnetic tape of an opposite side at the close side which contacts a magnetic tape first so that it may consider as size. Thereby, the difference of the head abrasion loss by the difference in the thickness of the air film from which the appearance side produces an antiwear characteristic rather than the close side of a magnetic tape by rotation of the cylinder by the side of a large next door, close [of a magnetic tape], and appearance is suppressed. Therefore, the magnetic head is worn out in abbreviation homogeneity in a close [of a magnetic tape], and appearance side, and it becomes possible to obtain the magnetic head by which record reproducing characteristics were stabilized.

[0031]

[Example] Hereafter, with reference to the example shown in the drawing, the magnetic head concerning this invention is explained still in detail.

[0032] <an example 1> -- the segment in the magnetic head which constituted the main magnetic circuit from a metal magnetic film which drawing 1 is drawing having shown typically the important section cross section of the magnetic head of this invention for explaining the sliding-surface configuration of the magnetic head, for example, is shown in drawing 4 -- it is the cross-sectional view of X-X'

[0033] Drawing 4 is the front view seen from the magnetic tape sliding-surface side, and 2 is the height of a core base, and a core half object with which in magnetic-gap (operation gap), 5, and 5' a metal magnetic film and 7 make 8A, and, as for 8B, magnetic substrate material and 6 make [protection and adhesives, and 3] a pair.

[0034] Each core half objects 8A and 8B equip the abutting surface side of the magnetic substrate materia 5 and 5' which consist of ferrite material, respectively, and the magnetic substrate material 5 and 5' with the metal magnetic film 6 which carried out covering formation, and the height 7 which presents abbreviation Yamagata is formed in the each magnetic substrate material 5 and matching side side of 5' by machining. In addition, abbreviation Yamagata as used in the field of this invention shows the salient which becomes a taper gradually as it goes at a nose of cam, and in the example of drawing 4 , although it is the point-angle Yamagata salient of reverse V typefaces, a configuration with the flat summit section of a point-angle Yamagata salient is also included in this. The metal magnetic film 6 has [in / the crowning of a height 7 / thickness formation of predetermined is carried out for the metal magnetic film 6 by vacuum thin film creation technology, and] the flat part which specifies the width of recording track Tw in the forming face side of this height 7.

[0035] And while comparing the flat part comrade of this metal magnetic film 6 through a gap regulation film (nonmagnetic thin film), joining and forming a magnetic gap 3, it has structure which joined the core half objects 8A and 8B, and was unified by the protection material 2, such as a low melting glass. In addition, as shown in the perspective diagram of drawing 2 , the aperture 4 for coils is formed at least in one side of the core half objects 8A and 8B, and the coil is wound using this aperture for coils.

[0036] The magnetic head which constituted the main magnetic circuit from such a metal magnetic film performs record reproduction of an information signal in contact with a magnetic tape by the sliding surface 1, as shown in drawing 2 . The width of face W of this sliding surface 1 is set as 70 micrometers so that good tape contact may be obtained.

[0037] Moreover, the radius of curvature R of the head sliding direction of this sliding surface 1 is made into

smallness near the head gap, and the sliding surface of the magnetic head is made into the hyperbola configuration so that it may consider as size as it separates from a head gap. In this example, it sets at (2) ceremony described above, for example, and they are a**10 micrometers and b**c**250micrometer. It is considering as the hyperbola configuration when carrying out. Thereby, it is the radius of curvature near the head gap. Radius of curvature R1**8mm and near the magnetic-head edge R2**15mm It becomes.
[0038] Moreover, since the configuration of the direction (the direction of sliding width-of-face W) which intersects perpendicularly in the head sliding direction has the small wear volume of the sliding cross direction, a wear life is not influenced directly. Therefore, for the configuration expressed with the conventionally same single radius-of-curvature R' as a head being sufficient, and good tape contact being obtained as a result of examination, radius of curvature is 0.5 mm<=R'<=5mm. What is necessary is just within the limits. Then, at this example, it is radius of curvature. R'=2mm It is processed so that it may become. And on the cylinder, it projects and the magnetic head which processed the sliding-surface configuration as mentioned above is attached so that a head nose of cam may set to 50 micrometers from a cylinder front face.
[0039] By [which were described above] carrying out sliding-surface configuration processing of the magnetic head like, it sets in early stages of a magnetic tape run, and is single radius of curvature. R= 8mm It wears out in a speed of the same grade as the magnetic head. And the large next door and the wear rate fall [radius of curvature R] with run progress. Therefore, since good tape contact is obtained to a short-time tape run, the long lasting magnetic head can both be obtained as stable record reproducing characteristics are obtained.
[0040] The run wear property of the magnetic head by this invention of composition of having explained above is shown in drawing 3 as contrasted with the conventional magnetic head of single radius of curvature. However, the conventional magnetic head is single radius of curvature. R= 10mm Carrying out, the component of the amount of projections from a cylinder, the sliding-surface width of face W, and the magnetic head presupposed that it is the same as that of the magnetic head by this invention. Moreover, the tape at this time and relative velocity of a head were made into 5.8 m/s of VHS-VTR.
[0041] The tape transit time until it is set to abrasion loss deltaGd=18micrometer of the limitation of operating as the magnetic head turns into about 4000 hours with the head of this example to about 3200 hours of a head conventionally so that more clearly than this drawing. Therefore, the head of this example becomes long lasting about about 25% compared with a head conventionally.
[0042] Moreover, less than [tape transit-time 1400 hour], abrasion loss deltaGd of the head of this example serves as size compared with the case of the conventional head. This is because the radius of curvature near the head gap is smallness, and the transit time until a head gets used to a tape by this also becomes short. Consequently, time until the wave of a reproduction envelope-detection output signal becomes good was about 15 hours with the head of this example to about 35 hours of a head conventionally. Thus, the head of this example can obtain good record reproducing characteristics conventionally in 1/2 or less time in the case of a head. Moreover, although this example showed comparison with the conventional head with a single radius of curvature of R= 10mm, even if it compares with the case of other radius of curvatures, the predominance of this invention is clear. For example, in the case of R= 8mm single radius of curvature, time until the wave of a reproduction envelope-detection outpu signal becomes good is almost the same as the case of this example. However, the tape transit time until it is set to abrasion loss deltaGd=18micrometer turns into 2400 or less hours, is related long lasting, and has a problem. Thus, it is difficult to reconcile obtaining record reproducing characteristics for a short time and reinforcement in the magnetic head of single radius of curvature.
[0043] <Example 2> Although the case where the example described above made the same configuration the sliding surface of the magnetic head by the side of the appearance of the magnetic tape of the opposite side the entering side which contacts a tape first was described, this invention is not restricted to this. For example, it constitutes so that the sliding-surface configuration of the magnetic head is made into a hyperbola configuration, and the inclination (a/b) of the asymptote may be made into smallness by the magnetic tape's entering side and may be made into size by the appearance side of a magnetic tape.
[0044] In this example, as shown in drawing 7 , the sliding surface of the magnetic head is set for example, at above-mentioned (2) ceremony, and it is at a magnetic tape's entering side. It is referred to as a**10 micrometers and b**c**250micrometer, and is at the appearance side of a magnetic tape. a**10 micrometers and b**c**290micrometer It is considering as the hyperbola configuration when carrying out.

[0045] With VTR, since high-speed rotation of the rotating cylinder is carried out, an air film generates it around it. In the close side of the magnetic head which contacts a magnetic tape first, this air film becomes thick, in order that a head may operate in the direction which rushes into a tape. On the contrary, in the appearance side of the magnetic tape of an opposite side, in order to operate in the direction in which a head escapes from a tape, an air film becomes thin. Therefore, it will be easier to wear rather than the close side of a magnetic tape out an appearance side.
[0046] In the magnetic head by this example, the radius of curvature by the side of the appearance of the magnetic tape which is easy to wear out is made into size compared with the magnetic tape's entering side and the variation in the abrasion loss by the side of entering of a magnetic tape and appearance is suppressed. Consequently, about the reinforcement of the tape transit time until the wave of a envelope-detection output signal becomes good, or the magnetic head, the almost same performance as the case of an example 1 was able to be secured, and the reproduction envelope-detection output signal further stabilized rather than the case of an example 1 was able to be obtained.
[0047] <Example 3> Although the case where the example described above made the sliding surface of the magnetic head a hyperbola configuration was described, this invention is not restricted to this. For example in the case which show in following the (4) formula of the parabola configuration which shows the sliding surface of the magnetic head in following the (3) formula, and elliptical, this invention is applicable.
[0048]
[Equation 3]

$$x^2 = 4py \qquad \cdots (3)$$

[0049] (However, in order to set the X-axis as a Y-axis and the tape sliding direction for the direction of a magnetic-gap side, x and y of the equation of a general parabola are replaced.)
[0050]
[Equation 4]

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \qquad \cdots (4)$$

[0051] For example, the sliding surface of the magnetic head is made into the parabola configuration of p= 5 (mm) in (3) formulas. Or it considers as elliptical [from which the peak on a Y-axis serves as a head gap position of the sliding surface of the magnetic head among the ellipses which set to b= 10 (mm) in (4) formulas, and made a size a little than 10 (mm)].
[0052] The radius of curvature R of the sliding surface of the magnetic head formed by this serves as size as it is R1=10mm and separates from a head gap near the head gap. Therefore, it sets in early stages of a magnetic tape run, and is single radius of curvature. R= 10mm It wears out in a speed of the same grade as the magnetic head. And in run progress, radius of curvature R is a large next door, and a wear rate is single radius of curvature. R= 10mm It falls rather than the magnetic head.
[0053] That is, also in this example, although it was inferior to the example 1 a little, the same effect as an example 1 referred to as that a good regenerative-detection output signal is obtained to a short-time tape run, and the long lasting magnetic head is obtained was able to be acquired.
[0054]
[Effect of the Invention] As stated above, this invention was able to attain the desired end. That is, a good reproduction envelope-detection output signal is obtained to a short-time tape run, and let an antiwear characteristic be a good thing. Therefore, the magnetic head which secured good record reproducing characteristics for a short time, and realized reinforcement can be obtained.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The cross-sectional view of the magnetic-head important section for explaining the object for principle explanation of this invention, and the sliding-surface configuration of the magnetic head used as example.
[Drawing 2] Similarly it is the important section perspective diagram of the magnetic head.
[Drawing 3] Similarly it is the wear property view of the magnetic head.
[Drawing 4] Similarly it is the front view of the sliding surface of the magnetic head.
[Drawing 5] The plan showing the sliding-surface configuration of the conventional magnetic head.
[Drawing 6] Front view of the sliding surface of the conventional magnetic head.
[Drawing 7] The cross section showing the sliding-surface configuration of the magnetic head used as othe examples of this invention.
[Description of Notations]
1 -- Sliding surface
2 -- Protection and binder
3 -- Magnetic gap
4 -- Coil aperture
5 5' -- Magnetic substrate material
6 -- Metal magnetic film
9 -- Hyperbola configuration
10 -- Single radius-of-curvature configuration.

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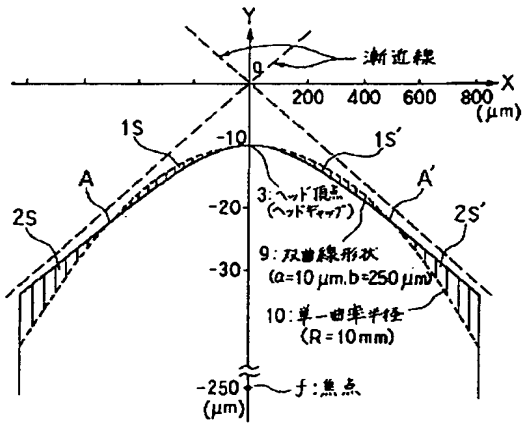
DRAWINGS

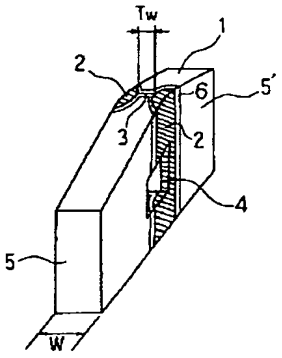
[Drawing 1]

図 1



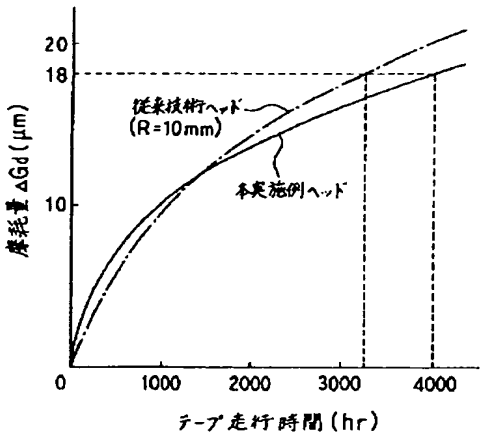
[Drawing 2]

図 2



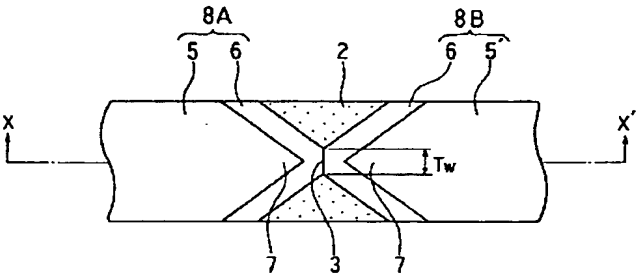
[Drawing 3]

図3



[Drawing 4]

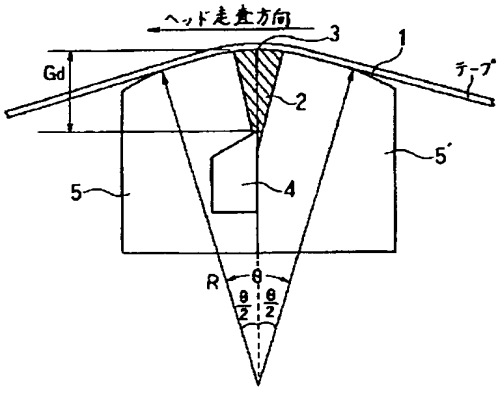
図4



2·····保護及び接着材
3·····磁気ギャップ
5.5'·····磁性基板材
6·····金属磁性膜
7·····突起部
8A、8B···コア半体

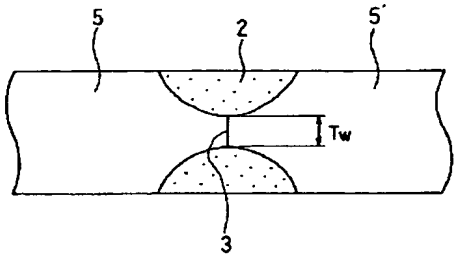
[Drawing 5]

図5



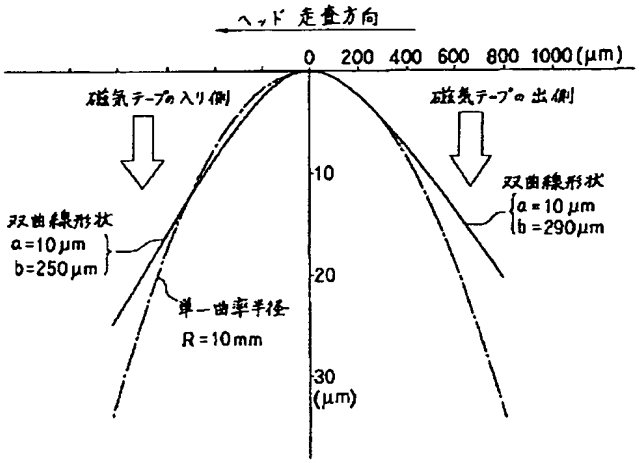
[Drawing 6]

図 6



[Drawing 7]

図 7



[Translation done.]

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(54)【発明の名称】　磁気ヘッド

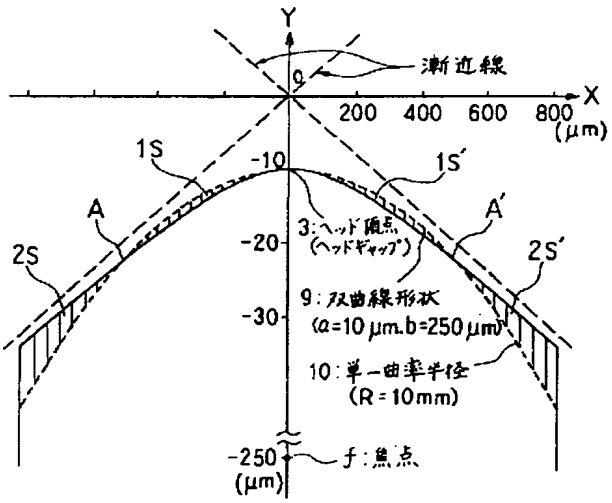
(57)【要約】

【目的】良好な記録再生特性が短時間でえられ、且つ長寿命化を実現した磁気ヘッドを提供することにある。

【構成】磁気ヘッドの磁気テープとの摺動面形状を、ヘッド走査方向の曲率半径Ｒが、ヘッドギャップ近傍では小、ヘッドギャップから離れるに従って大となるように構成する。

【効果】ヘッドギャップ近傍の曲率半径は小さいので、摩耗速度は速く、短時間のテープ走行で良好な再生包絡線検波出力信号が得られる。そして、ヘッドギャップから離れるにしたがい曲率半径は大きくなるので、摩耗速度は遅くなり、耐摩耗特性を良好なものとすることができる。

図１



【特許請求の範囲】
【請求項１】回転シリンダに搭載し、所定の相対速度で磁気テープと摺動して情報信号の記録再生を行なう磁気ヘッドであって、
磁気テープとの摺動面のヘッド走査方向の曲率半径Ｒを、ヘッドギャップ近傍では小とし、ヘッドギャップから離れるに従って大とするように構成して成る磁気ヘッド。
【請求項２】磁気テープ摺動面のヘッド走査方向の磁気ヘッドの先端形状を略双曲線形状として成る請求項１記載の磁気ヘッド。
【請求項３】磁気ヘッドの磁気テープとの摺動面形状を示す双曲線の漸近線の傾き ａ／ｂを、最初に磁気テープに当接する入側では小とし、反対側の磁気テープの出側では大として成る請求項１もしくは２記載の磁気ヘッド。
【請求項４】磁気テープ摺動面のヘッド走査方向の磁気ヘッドの先端形状を略放物線形状として成る請求項１記載の磁気ヘッド。
【請求項５】磁気テープ摺動面のヘッド走査方向の磁気ヘッドの先端形状を略楕円形状として成る請求項１記載の磁気ヘッド。
【請求項６】ヘッドギャップ近傍の磁気テープ摺動面のヘッド走査方向の曲率半径R_1を、
３mm ≦ R_1 ≦ １０mm
と成し、
磁気テープ摺動面のヘッド走査方向の磁気ヘッド端近傍の曲率半径R_2を、
１０mm ≦ R_2 ≦ ２０mm
として成る請求項１乃至５何れか一に記載の磁気ヘッド。
【請求項７】ヘッド走査方向の磁気テープ摺動面の幅Ｗを
５０μm ≦ Ｗ ≦ １００μm
として成る請求項１乃至６何れか一に記載の磁気ヘッド。
【請求項８】逆Ｖ字状の山形突起形状を有し磁気回路を構成する一対の金属磁性膜が非磁性材を介してその突起部において互いに突き合わせて成り、逆Ｖ字状の形状の断面部分が磁気テープ対向面に露出し、一対の金属磁性膜の突起部の先端は互いに並行で且つヘッド走査方向に略直角な平面であり、この平面と磁気テープ対向面との交線で示される平面の幅はトラック幅に対応し、少なくとも一方の金属磁性膜はコイル巻線窓を有し、且つ金属磁性膜は逆Ｖ字状に対応する形状の突起部を有する磁性基板材上に形成されて成る請求項１乃至７何れか一に記載の磁気ヘッド。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は磁気記録再生装置に用いる磁気ヘッドに係り、特に高速のヘッド走査が要求されるＶＴＲに好敵な磁気ヘッドに関する。
【０００２】
【従来の技術】一般に、ＶＴＲでは、広帯域信号の記録再生を行うため、回転シリンダに搭載した磁気ヘッドと磁気テープ間の相対速度を高速としている。そのため、磁気ヘッドを磁気テープに良好に当接させることが必要であり、スペーシング（磁気ヘッドとテープ間の隙間）等が発生すると磁気ヘッドの記録再生特性が損なわれることになる。このような不都合を抑え、良好な記録再生特性を得るためには、磁気テープと当接する磁気ヘッドの形状（以下、磁気ヘッドの摺動面形状と称す）が重要となる。
【０００３】従来からの磁気ヘッドの摺動面形状を図５，図６を用いて説明する。図５は、従来の磁気ヘッドの摺動面形状を示す概略平面図であり、図６は、従来の磁気ヘッドの摺動面の正面図である。図５において、一対のフェライトコア基体５，５’を、所定の磁気ギャップ長が得られるようにそれぞれのコアの突合せ面に非磁性膜（図示せず）を形成し、磁気ギャップ３を規制している。
【０００４】また、図６に示すヘッド走査方向に垂直なトラック幅Ｔｗの規制は、フェライトコア基体５，５’に切り欠け部２を設けることにより行い、この切り欠け部２にはフェライトコアを接合するためのガラスを充填している。そして、良好なテープコンタクトを得るために、磁気ヘッドのテープ摺動面１にはヘッド走査方向の曲率半径がＲの形状加工（以下、Ｒ形状加工と称す）が施されている。尚、この時のヘッド走査方向のテープ当接角はθとなる。
【０００５】一般に、このＲ形状加工は、研削加工機、或いは研磨テープを用いて行われている。このように、ヘッド摺動面のヘッド走査方向にＲ形状加工を施すことにより、テープ摺動面近傍の磁気テープの変形がテープ摺動面形状と略同一と成る。従って、磁気テープとの良好な当接が得られ、スペーシングロスが小さく記録再生特性の優れた磁気ヘッドが得られる。
【０００６】なお、このような磁気テープとの良好な当接に関するものとして、例えば1986年テレビジョン学会全国大会予稿集第１５７頁～第１５８頁に記載の“テープ浮上特性数値解析の４連ヘッドＶＴＲへの適用”が挙げられる。
【０００７】
【発明が解決しようとする課題】上記のような磁気ヘッドの摺動面形状により、磁気テープとの当接は良好となる。しかし、従来からの磁気ヘッドでは、磁気テープとの当接に関する摺動面形状のみで、磁気ヘッドの摩耗寿命に関する摺動面形状については何ら考慮されていなかった。このテープ摺動面のＲ形状は、磁気ヘッドの摩耗寿命にも影響を及ぼすことが、以下に示す検討により明

らかになった。

【０００８】一般に、磁気ヘッドの摩耗寿命は、図５に示す磁気ギャップ面の長さＧｄで決定される。摩耗寿命を長くするにはＧｄを長く設定すればよいが、長さに応じてギャップ部の磁気抵抗が小さくなり、記録磁界が減少してしまう。また、ギャップ部を通る磁束が多くなるため、再生効率も低下してしまう。従って、Ｇｄの長さのみで長摩耗寿命化を図ると記録再生特性が損なわれるという問題がある。

【０００９】一方、ヘッド走査方向の曲率半径Ｒと磁気ギャップ面の長さＧｄの摩耗量ΔＧｄは、近似的に下記（１）式のように表わされる。

【００１０】

【数１】

$$\Delta Gd \propto \frac{V}{R \cdot Sin(\theta/2) \cdot W} \quad \cdots (1)$$

【００１１】（Ｖ：摩耗体積、θ：ヘッド走査方向のテープ当接角（図５に示すθ）、Ｗ：テープ幅方向の摺動幅）

（１）式から明らかなように、摺動幅Ｗを一定にした場合、摩耗寿命を長くするにはテープ走行方向の曲率半径Ｒを大きくすればよい。しかし、曲率半径Ｒを大きくすると、以下に示す要因により、良好なテープ当接が得られるまでに長時間を要する、と言う問題がある。

【００１２】すなわち、磁気テープ走行初期においては、磁気ヘッドの組立誤差、回転ドラムの加工誤差等により、磁気ヘッドのテープ摺動面形状と磁気ギャップ近傍のテープ変形とに差が生じる。そのため、スペーシングロスが大となり、良好な記録再生特性が得られにくい。そこで、このテープ摺動面形状がテープ変形になじむまで、すなわちテープ摺動面形状とテープ変形とが略同一となるまで磁気テープの馴らし走行を行い、磁気ヘッド摺動面の研削を行う必要がある。しかし、曲率半径Ｒを大きくすると摩耗速度も遅くなるめ、テープ摺動面形状がテープ変形になじむまでに長時間を要する。従って、曲率半径Ｒを大きくすると、良好なテープ当接が得られるまでに長時間を要することになる。

【００１３】馴らし走行時間を短くするには、磁気ヘッドのテープ摺動面形状、磁気ヘッドの組立、及び回転ドラムの加工等の精度を上げるか、曲率半径Ｒを小さくして磁気ヘッドを摩耗しやすくすればよい。しかし、摺動面形状や組立加工等の精度には限界があり、また精度を得るためには各種微調整等に時間を要する。その結果、効率が悪くなり歩留まりも低下するため、精度を上げることは量産には適さない。また、曲率半径Ｒを小さくすると、摩耗寿命が短くなるという問題がある。

【００１４】従って、本発明の目的は、上記従来技術の問題点を解決し、短時間の馴らし走行で良好な記録再生特性が得られ、且つ長寿命の磁気ヘッドを提供することにある。

【００１５】

【課題を解決するための手段】上記問題を解決するために本発明は、磁気ヘッドの磁気テープとの摺動面のヘッド走査方向の曲率半径Ｒを、ヘッドギャップ近傍では小とし、ヘッドギャップから離れるに従って大とするように構成する。

【００１６】例えば、ヘッドギャップからの位置により、磁気ヘッドの磁気テープとの摺動面の曲率半径Ｒを異ならせるために、磁気テープ摺動面のヘッド走査方向の磁気ヘッドの摺動面形状を略双曲線形状とするように構成する。

【００１７】この時、回転シリンダの高速回転により生じる空気膜は、最初に磁気テープに当接する磁気ヘッドの入側では厚く、反対側の磁気テープの出側では薄くなる。すなわち、磁気ヘッドの入側よりも出側の方が摩耗されやすい。そこで、磁気ヘッドの磁気テープとの摺動面形状を示す双曲線の漸近線の傾き（ａ／ｂ）を、最初に磁気テープに当接する入側では小とし、反対側の磁気テープの出側では大とするように構成しても良い。

【００１８】但し、実用的に好ましい条件を示すと、曲率半径Ｒ＝３ｍｍより小さい場合には、摩耗寿命が著しく短くなり、逆にＲ＝１０ｍｍより大きい場合には、磁気ヘッド摺動面の研削が短時間では困難となる。更に、Ｒ＝２０ｍｍより大きい場合には、磁気ヘッドと磁気テープ間のスペーシングロスが増加し、良好なテープ当接が得られない。等の理由により、ヘッドギャップ近傍の磁気テープ摺動面のヘッド走査方向の曲率半径R_1を、

$3mm \leqq R_1 \leqq 10mm$

磁気テープ摺動面のヘッド走査方向の磁気ヘッド端近傍、すなわち、磁気ヘッドとテープとの摺動端部の曲率半径R_2を、

$10mm \leqq R_2 \leqq 20mm$

とすることが望ましい。この時、磁気ヘッドは、その主磁気回路を金属磁性膜、或いは高透磁率を有するフェライト材で構成する等、特に限定するものではない。

【００１９】また、磁気ヘッドと磁気テープとの摺動面の幅Ｗは、Ｗ＝５０μｍより小さい場合には磁気ヘッドの磁気テープとの摺動面の強度が弱くなり、テープ走行中にゴミ等の影響でヘッドの破損が生じてしまう。逆に、Ｗ＝１００μｍより大きい場合には、摩耗寿命に関しては有利であるが、検討によると、磁気テープの剛性の違いにより良好なテープ当接が得られない等の問題がある。等の理由により、実用的に好ましくは、

$50\mu m \leqq W \leqq 100\mu m$

とする。

【００２０】更に、ヘッド走査方向の曲率半径Ｒが、ヘッドギャップ近傍では小で、ヘッドギャップから離れるに従って大となる放物線形状、或いは楕円形状となるように磁気ヘッドの摺動面形状を構成してもよい。

【００２１】

【作用】本発明の磁気ヘッドにおける曲率半径Ｒの作用を、図１を用いて説明する。同図は、曲率半径Ｒが、ヘ

ッドギャップ近傍では小でヘッドギャップから離れるに従って大となるような例えば双曲線形状とした場合と、曲率半径Ｒを一定とした場合との、ヘッド走査方向のテープとの摺動面形状の比較を模式的に示す磁気ヘッドの横断面図である。但し、同図において、双曲線で表した本発明の摺動面形状を実線９で示し、単一曲率半径で表した従来の摺動面形状を破線１０で示す。

【００２２】実線９で示す双曲線は、磁気ギャップ面方向をＹ軸、テープ摺動方向をＸ軸とした場合、下記（２）式で表わされる。

【００２３】

【数２】

$$\frac{y'^2}{a^2} - \frac{x'^2}{b^2} = 1 \qquad \cdots (2)$$

【００２４】ここで、ａ及びｂは双曲線の形状を決定する定数であり、双曲線の二つの漸近線 Ｙ＝±（ａ／ｂ）・Ｘ の交点（Ｘ，Ｙ軸の原点）からヘッド頂点３（ヘッドギャップ）までの距離がａとなる。そして、原点から双曲線の焦点ｆまでの距離をｃとすると、０＜ａ＜ｃ及び　$c^2=a^2+b^2$　の関係にある。

【００２５】図１において、実線９で示す双曲線で表した摺動面形状と、破線１０で示す単一曲率半径で表される従来ヘッドの摺動面形状とは点Ａ，Ａ’で交差する。従って、双曲線形状の磁気ヘッドは、単一曲率半径形状の従来の磁気ヘッドに対し、図１の斜線部１ｓ，２ｓ，１ｓ’，２ｓ’で示す横断面形状の相違を得る。

【００２６】磁気ギャップ面の長さＧｄの摩耗量ΔＧｄは、摺動幅を同一とすれば（１）式から明らかなように、摩耗体積Ｖに比例する。すなわち、摩耗量ΔＧｄは、図１に示した磁気ヘッドのテープ摺動部の断面積に比例する。また、テープ走行初期ではヘッドギャップ近傍にのみテープが当接し、走行するにしたがってテープが摺動面全体に当接するようになる。

【００２７】この時、図１に示すようにテープ走行初期においては、破線１０の従来の磁気ヘッドの方が、実線９より横断面積が１ｓ，１ｓ’だけ大きいため、従来ヘッドの方が摩耗速度が遅くなる。そして、走行するにしたがって研磨され、点Ａ，Ａ’まで摩耗されると、テープ走行初期とは逆に破線１０より実線９の方が、横断面積が２ｓ，２ｓ’だけ大きいため、本発明の双曲線形状の磁気ヘッドの方が摩耗速度が遅くなる。

【００２８】すなわち、従来の単一曲率半径形状ヘッドに比べてテープとの摺動面形状を双曲線とした本発明の磁気ヘッドは、テープ走行初期においては摩耗速度は速く、走行するにしたがって摩耗速度は遅くなる。これにより、短時間の馴らし走行で安定なヘッドテープコンタクト状態が得られ、且つ走行にしたがい摩耗速度が遅くなるので長寿命の磁気ヘッドが得られる。

【００２９】従って、磁気ヘッドのテープ摺動面の曲率半径が、例えば双曲線のようにヘッドギャップ近傍では小さく、ギャップから離れるにしたがって連続的に大きくなるように構成する。これにより、短時間で良好な記録再生特性が得られ、且つ磁気ヘッドの長寿命化も実現可能となる。

【００３０】また、磁気ヘッドの磁気テープとの摺動面形状を示す双曲線の漸近線の傾き（ａ／ｂ）を、初めに磁気テープに当接する入側では小とし、反対側の磁気テープの出側では大とするように構成する。これにより、磁気テープの入側よりも出側の方が耐摩耗特性は大となり、磁気テープの入側と出側でのシリンダの回転により生じる空気膜の厚さの違いによるヘッド摩耗量の差は抑制される。従って、磁気テープの入側と出側とで磁気ヘッドは略均一に摩耗され、記録再生特性が安定した磁気ヘッドを得ることが可能となる。

【００３１】

【実施例】以下、図面に示した実施例を参照して、本発明に係る磁気ヘッドを更に詳細に説明する。

【００３２】〈実施例１〉図１は、磁気ヘッドの摺動面形状を説明するための本発明の磁気ヘッドの要部横断面を模式的に示した図で、例えば、図４に示す金属磁性膜で主磁気回路を構成した磁気ヘッドでの線分Ｘ－Ｘ’の横断面図である。

【００３３】図４は、磁気テープ摺動面側から見た正面図であり、２は保護及び接着剤、３は磁気ギャップ（作動ギャップ）、５，５´は磁性基板材、６は金属磁性膜、７はコア基体の突起部、８Ａ，８Ｂは対をなすコア半体である。

【００３４】各コア半体８Ａ，８Ｂは、それぞれフェライト材よりなる磁性基板材５，５´と、磁性基板材５，５´の突合せ面側に被着形成した金属磁性膜６とを備えており、各磁性基板材５，５´の突合わせ面側には、略山形を呈する突起部７が機械加工によって形成されている。尚、本発明で云う略山形とは、先端に行くに従って漸次先細になる突起を示しており、図４の例では、逆Ｖ字形の尖角山形突起であるが、尖角山形突起の頂上部が平坦な形状もこれに含まれる。この突起部７の形成面側に、金属磁性膜６が真空薄膜作成技術によって所定の膜厚形成されており、また、突起部７の頂部において金属磁性膜６はトラック幅Ｔｗを規定する平坦部をもつものとなっている。

【００３５】そして、この金属磁性膜６の平坦部同志をギャップ規制膜（非磁性薄膜）を介して突合せ、接合して磁気ギャップ３を形成すると共に、低融点ガラス等の保護材２によって、コア半体８Ａ，８Ｂを接合、一体化した構造となっている。なお、コア半体８Ａ，８Ｂの少なくとも一方には、図２の斜視図に示すように巻線用窓４が形成されており、この巻線用窓を利用してコイルが巻回されている。

【００３６】このような金属磁性膜で主磁気回路を構成した磁気ヘッドは、図２に示すように、摺動面１で磁気

テープと当接して情報信号の記録再生を行う。この摺動面１の幅Wは、良好なテープ当接が得られるように、例えば７０μmに設定している。

【００３７】また、この摺動面１のヘッド摺動方向の曲率半径Ｒを、ヘッドギャップ近傍では小とし、ヘッドギャップから離れるに従って大とするように、磁気ヘッドの摺動面を双曲線形状としている。本実施例では、例えば上記した（２）式においてａ≒１０μm、ｂ≒ｃ≒２５０μm としたときの双曲線形状としている。これにより、ヘッドギャップ近傍の曲率半径 R_1≒８mm 、磁気ヘッド端近傍の曲率半径 R_2≒１５mm となる。

【００３８】また、ヘッド摺動方向に直交する方向（摺動幅W方向）の形状は摺動幅方向の摩耗体積が小さいために摩耗寿命には直接影響しない。したがって、従来ヘッドと同じ単一曲率半径Ｒ’で表される形状でもよく、検討の結果、良好なテープ当接が得られるのは曲率半径が ０．５mm≦Ｒ’≦５mm の範囲内であれば良い。そこで、本実施例では例えば、曲率半径 Ｒ’＝２mm となるように加工されている。そして、以上のように摺動面形状を加工した磁気ヘッドは、シリンダ上にヘッド先端がシリンダ表面から例えば５０μmとするように突出して取り付けられている。

【００３９】以上述べたように磁気ヘッドを摺動面形状加工することにより、磁気テープ走行初期においては、単一曲率半径 Ｒ＝８mm の磁気ヘッドと同程度の速さで摩耗される。そして、走行経過と共に曲率半径Ｒは大となり、摩耗速度は低下していく。従って、短時間のテープ走行で良好なテープ当接が得られるため、安定した記録再生特性が得られる、と共に長寿命の磁気ヘッドを得ることができる。

【００４０】以上説明した構成の本発明による磁気ヘッドの走行摩耗特性を、単一曲率半径の従来の磁気ヘッドと対比して、図３に示す。但し、従来の磁気ヘッドは、単一曲率半径 Ｒ＝１０mm とし、シリンダからの突出し量、摺動面幅Wや磁気ヘッドの構成材料は、本発明による磁気ヘッドと同一とした。また、この時のテープとヘッドの相対速度は、ＶＨＳ－ＶＴＲ相当の５．８m／ｓとした。

【００４１】同図より明らかなように、磁気ヘッドとして動作する限界の摩耗量ΔＧｄ＝１８μmとなるまでのテープ走行時間は、従来ヘッドの約３２００時間に対し、本実施例のヘッドでは約４０００時間となる。従って、本実施例のヘッドは、従来ヘッドに比べて、約２５パーセント程度長寿命となる。

【００４２】また、テープ走行時間１４００時間以下では、本実施例のヘッドの摩耗量ΔＧｄは、従来のヘッドの場合に比べて大となる。これは、ヘッドギャップ近傍の曲率半径が小のためであり、これによりヘッドがテープになじむまでの走行時間も短くなる。その結果、再生包絡線検波出力信号の波形が良好となるまでの時間は、従来ヘッドの約３５時間に対し、本実施例のヘッドでは約１５時間であった。このように、本実施例のヘッドは、従来ヘッドの場合の１／２以下の時間で良好な記録再生特性を得ることができる。また、本実施例では単一曲率半径Ｒ＝１０mmの従来ヘッドとの比較を示したが、他の曲率半径の場合と比較しても、本発明の優位性は明らかである。例えば、単一曲率半径Ｒ＝８mmの場合には、再生包絡線検波出力信号の波形が良好となるまでの時間は、本実施例の場合とほとんど同じである。しかし、摩耗量ΔＧｄ＝１８μmとなるまでのテープ走行時間は、２４００時間以下となり、長寿命に関して問題がある。このように、単一曲率半径の磁気ヘッドでは、短時間で記録再生特性を得ることと、長寿命化とを両立させることは困難である。

【００４３】〈実施例２〉以上述べた実施例は、初めにテープに当接する入り側と、その反対側の磁気テープの出側の磁気ヘッドの摺動面を同じ形状とする場合について述べたが、本発明はこれに限るものではない。例えば、磁気ヘッドの摺動面形状を双曲線形状とし、その漸近線の傾き（ａ／ｂ）を磁気テープの入り側では小とし、磁気テープの出側では大とするように構成する。

【００４４】本実施例では、図７に示すように、磁気ヘッドの摺動面を、例えば上記した（２）式において、磁気テープの入り側では ａ≒１０μm、ｂ≒ｃ≒２５０μmとし、磁気テープの出側では ａ≒１０μm、ｂ≒ｃ≒２９０μm としたときの双曲線形状としている。

【００４５】ＶＴＲでは、回転シリンダは高速回転されるため、その周辺には空気膜が発生する。この空気膜は、最初に磁気テープに当接する磁気ヘッドの入側では、ヘッドがテープに突入する方向に動作するため厚くなる。逆に、反対側の磁気テープの出側では、ヘッドがテープから逃げる方向に動作するため空気膜は薄くなる。そのため、磁気テープの入側よりも出側の方が摩耗されやすいことになる。

【００４６】本実施例による磁気ヘッドでは、摩耗しやすい磁気テープの出側の曲率半径を磁気テープの入り側に比べて大としており、磁気テープの入り側と出側での摩耗量のバラツキを抑制している。その結果、再生包絡線検波出力信号の波形が良好となるまでのテープ走行時間や磁気ヘッドの長寿命化に関しては、実施例１の場合とほとんど同じ性能を確保し、更に実施例１の場合よりも安定した再生包絡線検波出力信号を得ることができた。

【００４７】〈実施例３〉以上述べた実施例は、磁気ヘッドの摺動面を双曲線形状とした場合について述べたが本発明はこれに限るものではない。例えば、磁気ヘッドの摺動面を下記（３）式に示す放物線形状や、下記（４）式に示す楕円形状の場合においても、本発明は適用可能である。

【００４８】

【数３】

$$x^2 = 4py \qquad \cdots (3)$$

【００４９】（但し、磁気ギャップ面方向をＹ軸、テープ摺動方向をＸ軸とするため、一般の放物線の方程式のｘとｙを入れ替えている。）

【００５０】

【数４】

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \qquad \cdots (4)$$

【００５１】例えば、磁気ヘッドの摺動面を（３）式においてｐ＝５(mm)の放物線形状とする。或いは、（４）式においてｂ＝１０(mm)とし、ａを１０(mm)よりも若干大とした楕円のうち、Ｙ軸上の頂点が磁気ヘッドの摺動面のヘッドギャップ位置となるような楕円形状とする。

【００５２】これにより形成された磁気ヘッドの摺動面の曲率半径Ｒは、ヘッドギャップ近傍ではR1＝１０ｍｍであり、ヘッドギャップから離れるに従って大となっている。従って、磁気テープ走行初期においては、単一曲率半径 Ｒ＝１０mm の磁気ヘッドと同程度の速さで摩耗される。そして、走行経過と共に曲率半径Ｒは大となり、摩耗速度は単一曲率半径 Ｒ＝１０mm の磁気ヘッドよりも低下していく。

【００５３】すなわち、本実施例においても、実施例１には若干劣るものの、短時間のテープ走行で良好な再生検波出力信号が得られ、且つ長寿命な磁気ヘッドが得られると云う、実施例１と同様な効果を得ることができた。

【００５４】

【発明の効果】以上述べたように本発明により、所期の目的を達成することができた。すなわち、短時間のテープ走行で良好な再生包絡線検波出力信号が得られ、且つ耐摩耗特性を良好なものとすることができる。従って、良好な記録再生特性を短時間で確保し、且つ長寿命化を実現した磁気ヘッドを得ることができる。

【図面の簡単な説明】

【図１】本発明の原理説明用、及び実施例となる磁気ヘッドの摺動面形状を説明するための磁気ヘッド要部の横断面図。

【図２】同じく磁気ヘッドの要部斜視図。

【図３】同じく磁気ヘッドの摩耗特性図。

【図４】同じく磁気ヘッドの摺動面の正面図。

【図５】従来の磁気ヘッドの摺動面形状を示す平面図。

【図６】従来の磁気ヘッドの摺動面の正面図。

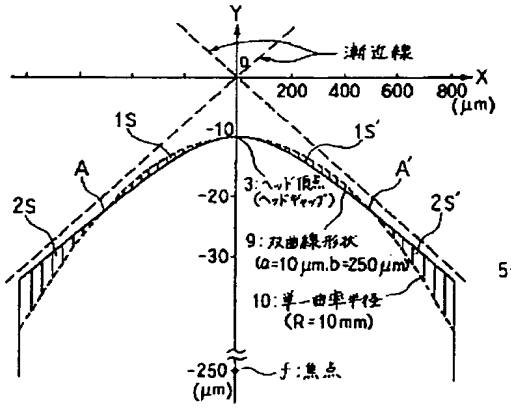
【図７】本発明の他の実施例となる磁気ヘッドの摺動面形状を示す断面図。

【符号の説明】

１…摺動面
２…保護及び接着材
３…磁気ギャップ
４…巻線窓
５，５′…磁性基板材
６…金属磁性膜
９…双曲線形状
１０…単一曲率半径形状。

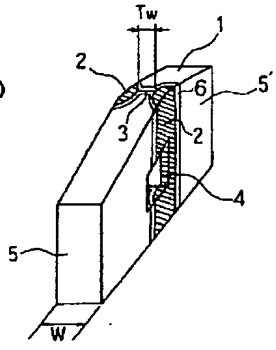
【図１】

図１



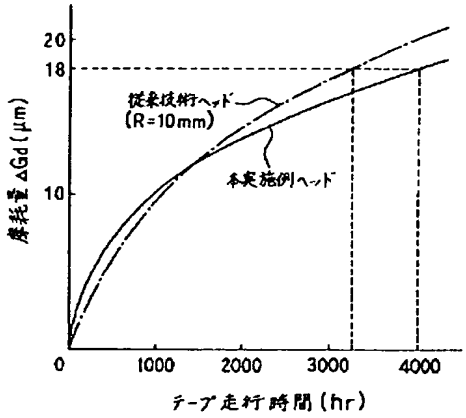
【図２】

図２



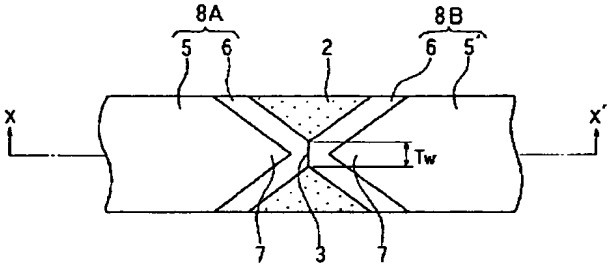
【図３】

図３



【図４】

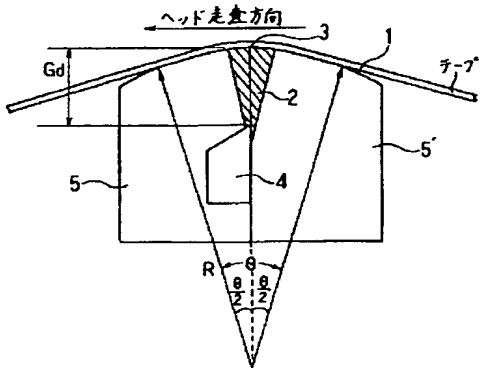
図4



2……保護及び接着材
3……磁気ギャップ
5.5'……磁性基板材
6……金属磁性膜
7……突起部
8A、8B…コア半体

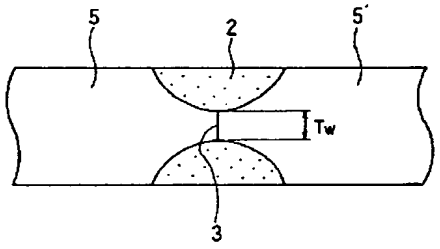
【図５】

図5



【図６】

図6



【図７】

図7